TECHNICAL MEMORANDUM

Project: **Issaquah School District – HS #4 / ES #17**

Subject: Updated Traffic Analysis for 228th Avenue SE Near Site

Date: May 18, 2021

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The Issaquah School District (ISD) proposes to co-locate a new elementary school (serving grades pre-kindergarten through 5) and a new high school (serving grades 9 through 12) on property located west of 228th Avenue SE and north of SE 43rd Way. The site is located within the City of Issaquah, but the site access driveway on 228th Avenue SE and frontage along 228th Avenue SE is within City of Sammamish jurisdiction. The *Transportation Technical Report (TTR, REVISED) for High School #4 / Elementary School #17*[1] presented the transportation impacts of the project to a broad study area and to all modes of transportation. The TTR's Section 4.4 *Traffic Operations Near Site* included detailed traffic operations and sensitivity analysis performed for the 228th Avenue SE / SE 43rd Way corridor from north of SE 40th Street to south of Providence Point Drive SE (221st Court SE). The sensitivity analysis evaluated how the corridor would perform with various lane configuration and traffic control alternatives under two different growth paradigms.

The City of Sammamish and its traffic consultant, Transportation Solutions, Inc. (TSI), have reviewed the near site analysis and recommended several global changes in traffic operating characteristics assumed in the model. In addition, new alternatives for the 228th Avenue SE / SE 40th Street intersection have been evaluated to help determine the optimal configuration. Finally, the prior analysis was performed using a mix of analysis methodologies that combined *Synchro* operations analyses and *SimTraffic* microsimulations. All analyses presented herein have been updated to reflect only the *SimTraffic* analysis, which is a microsimulation software platform that can account for coordination among traffic signals, merge conditions between intersections, and other elements that affect traffic operations. The changes made and updated results are presented herein.

1. Analysis Assumptions

Future Traffic Volumes

This analysis evaluates the same two traffic volume growth scenarios for year 2024 that were evaluated in the TTR to test the resiliency of the proposed improvements along 228th Avenue SE:

- **Low Growth** – Assumes a 1.5% per year background growth rate plus traffic from pipeline development projects (see Section 3.3.2 of the TTR); and
- **High Growth** – Assumes a 4.0% per year background growth rate plus traffic from pipeline development projects.

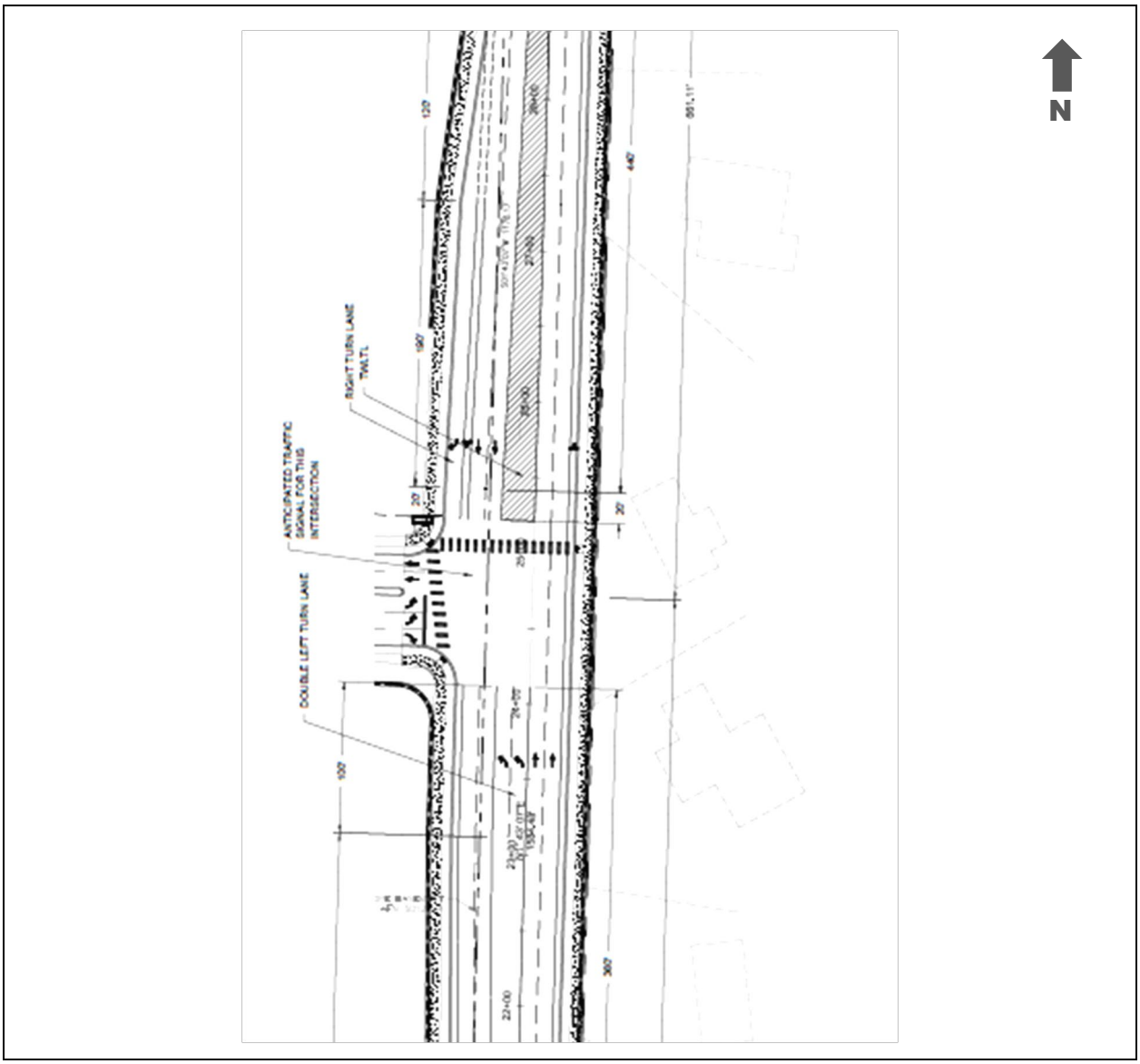
[1] Heffron Transportation, Inc., February 16, 2021.

The Low-Growth Scenario reflects the growth paradigm now expected by City of Sammamish staff. The High-Growth Scenario reflects a worst-case condition and shows how resilient the various configurations would be to further increases in traffic. Trips generated by the proposed schools would be the same for each of these conditions (see Section 4.1 of the TTR).

Intersection Site Access Driveway

Based on the prior analysis in the TTR, Issaquah School District chose to pursue Driveway Configuration Option 3. This signalized intersection configuration would have two through lanes in each direction on 228th Avenue SE, a dual left-turn lane in the northbound direction (to enter the site from the south), an auxiliary southbound right turn lane (to enter the site from the north), and three lanes exiting the proposed site access driveway. Figure 1 shows the proposed configuration assumed for all new analyses of the corridor.

Figure 1. Proposed Configuration of 228th Avenue SE / Site Access Driveway Intersection

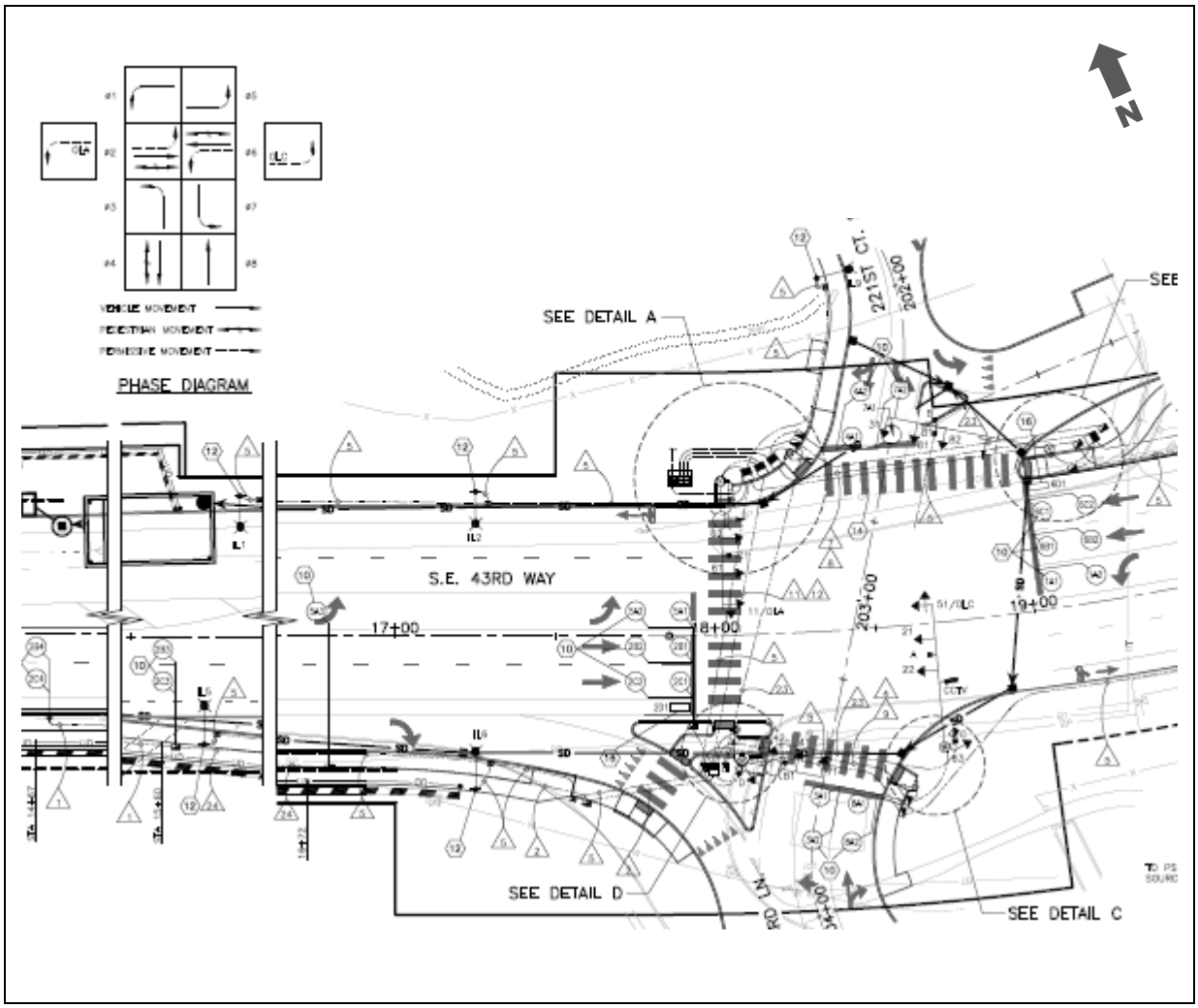


Source: AHBL, February 2021.

Intersection at Providence Point Drive and Transition to School Site

Construction plans and signal phasing information for this intersection (which is in the City of Issaquah and is still under construction as of May 2021). The assumed configuration and signal phasing is shown on Figure 2.

Figure 2. Proposed Configuration of 228th Avenue SE / Providence Point Drive SE Intersection



Source: Perteet, Signal and Illumination Plan, August 2019.

The traffic simulation model developed for the Issaquah School District – HS #4 / ES #17 project was updated to reflect the proposed configuration and operation. It is noted that in the southbound (downhill) direction, the current design configuration would have two-lanes adjacent to the school transition to one-lane, and then widen again to two lanes at the Providence Point Drive intersection. The approximately 175-foot segment, where only one southbound lane would exist, was included in the model to reflect merging operations for a worst-case condition.

Intersection at SE 40th Street

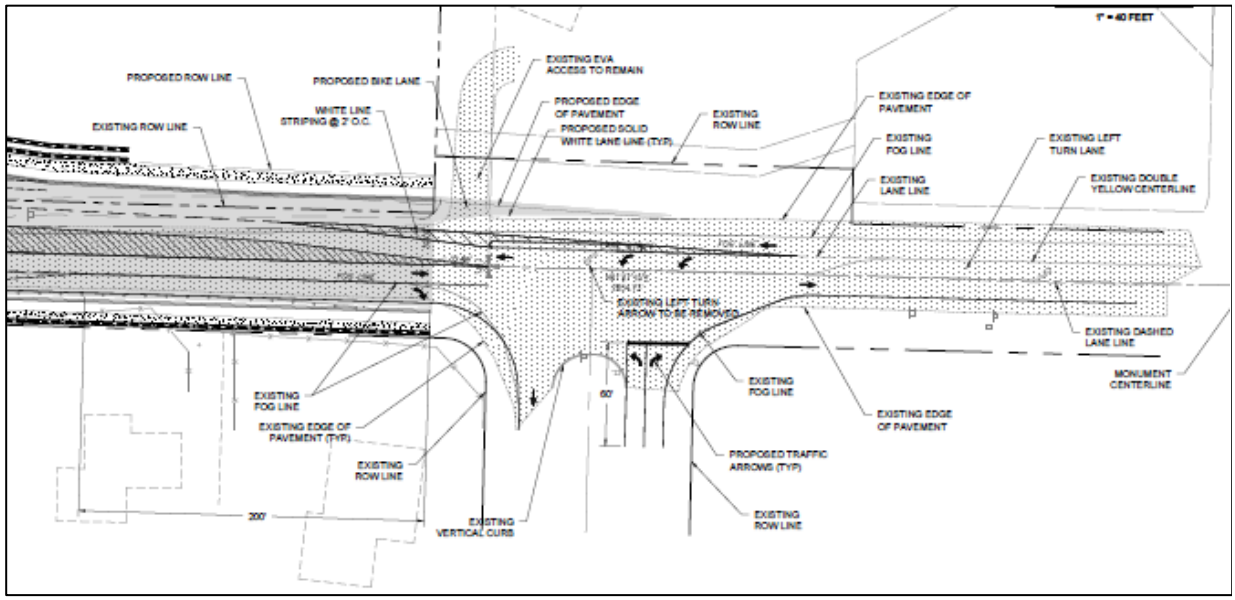
Most of the new modelling prepared for this updated analysis focused on the optimal configuration and traffic control for the SE 40th Street / 228th Avenue SE intersection. Three options were evaluated as described below.

A. **ISD Flying T Proposal –** This is the option previously evaluated in the TTR, and assumes a Flying T at SE 40th Street with a northbound right turn lane that drops at SE 40th Street. Northbound through traffic would merge south of the SE 40th Street intersection. This configuration is shown on Figure 3.

B. **Flying T with extended northbound through lane across SE 40th Street** – This would retain the Flying T intersection control in Option A above, but would convert the northbound right-turn lane to a shared through-right-turn lane and extend north of intersection (assumed to be 100 feet of full-width lane plus a 300-foot taper). For this option, the merge point would occur north of the SE 40th Street intersection.

C. **Signalize SE 40th Street and add neighborhood traffic calming –** This option had originally been evaluated in an earlier version of the TTR (September 2020) but then removed from consideration due to City concerns that it may attract cut-through traffic to the Sammamish Highlands neighborhood. Analysis by the City of Sammamish (described below) determined that the amount of cut-through would be relatively low. This option would add traffic calming measures installed along two potential short-cut routes through the Sammamish Highlands neighborhood.

Figure 3. SE 40th Street / 228th Avenue SE Intersection – Option A (Flying T)



Source: AHBL, February 2021.

Analysis for Option C was completed using the same road channelization as Option A, though without the lane separation that a Flying T configuration requires. Signalized pedestrian crosswalks were modeled across the north leg of 228th Avenue SE and across SE 40th Street. The north leg crosswalk was assumed to align with the wider shoulder walking route along SE 40th Street, which is along the north side of that street, it also provides the shortest crossing.

With a traffic signal, TSI estimated the potential cut-through using the City's "pipeline travel demand model." The results of that independent analysis were presented in a memorandum from TSI, *Issaquah School District High School #4/Elementary School #17, Traffic Analysis Supplement.*[2] This memorandum stated:

> "*Based on the pipeline travel demand forecast, signalization of 228th Ave SE & SE 40th St is anticipated to result in a net increase of approximately 67 non-Project westbound left-turn trips in the AM peak hour and 37 non-Project northbound right-turn trips in the PM peak hour at the intersection.*"

The future traffic volumes for Option C were adjusted to account for the cut-through traffic.

ISD would also create a pedestrian connection between SE 40th Street and the new Site Driveway. With the Flying T at SE 40th Street, the project would construct a pedestrian sidewalk on the east side of 228th Avenue SE from SE 40th Street to the Site Driveway. If a signal is installed at SE 40th Street, ISD would extend the sidewalk it is constructing on the west side of 228th Avenue SE to meet the signalized crosswalk (there would be no sidewalk constructed on the east side of 228th Avenue SE).

Saturation Flow Rates

The saturation flow rates in all models were reduced from the default of 1,900 vehicles per hour per lane (vphpl) to 1,750 vphpl, based on research conducted by TSI and presented in the *Traffic Analysis Supplement* memorandum.

2. Simulation Results

The near site traffic operations were evaluated using the *SimTraffic* microsimulation software. Results for the key intersections reflect the average of six 60-minute *SimTraffic* model runs.

2.1. Main Site Access

The main site access driveway on 228th Avenue SE with the proposal lane and signal configuration would operate at an overall level of service (LOS) B with the project and the previously described Low-Growth scenario for background traffic. With the High-Growth scenario, the intersection would be degraded to LOS C during the morning peak hour, but would remain at LOS B for the afternoon and PM peak hours. For all conditions, the worst movement at the intersection (which would be the northbound left turn into the site) would operate at LOS D or better. The level of service results are presented in Table 1.

[2] Transportation Solutions, Inc., April 26, 2021.

Table 1. Level of Service at 228th Ave SE / Site Access Driveway – 2024 With Project and Proposed Lane Configuration[a]

	Morning Peak Hour (7:15 – 8:15 A.M.)		Afternoon Peak Hour (3:00 – 4:00 P.M.)		Commuter PM Peak Hour (4:45 – 5:45 P.M.)	
	LOS [b]	Delay [c]	LOS	Delay	LOS	Delay
LOW-GROWTH SCENARIO (1.5% background growth per year)						
Overall Intersection	B	19.4	B	16.1	B	14.5
Eastbound Left-Turn	D	40.0	C	28.5	D	39.8
Northbound Left-Turn	C	30.4	D	36.5	D	47.6
Southbound Through	B	19.9	B	14.2	A	9.0
HIGH-GROWTH SCENARIO (4% background growth per year)						
Overall Intersection	C	20.2	B	16.0	B	13.1
Eastbound Left-Turn	D	45.6	C	30.6	D	39.1
Northbound Left-Turn	C	30.6	C	34.6	D	42.3
Southbound Through [d]	C	21.8	B	14.1	A	8.5

Source: Heffron Transportation, Inc., May 2021. All analyses assumed a saturation flow rate of 1,750 vph per lane. Delays determined using average of six 60-minute SimTraffic simulation runs.

a. Proposed configuration assumes two through lanes in each direction on 228th Avenue SE, a dual left-turn lane in the northbound direction (to enter the site from the south), an auxiliary southbound right turn lane (to enter the site from the north), and three lanes exiting the proposed site access driveway

b. LOS = Level of service.

c. Delay = Average seconds of delay per vehicle.

d. Decreases in delay for the southbound through movement are due to the fact that it is not a peak-direction movement during afternoon and PM peak hour conditions.

Queuing analysis determined the storage lengths needed to accommodate the 95th-percentile queues (meaning that the queues would be at that length, or shorter, for 95% of the peak hour). The results, presented in Table 2, reflect the longest queue of all three time periods evaluated. Along 228th Avenue SE, the queuing simulations indicate that the northbound left turn lanes would require about 240 feet of storage space; the southbound right-turn lane would require about 230 feet of queue storage space.

The operations and queuing analyses confirm that the proposed intersection design along with the site frontage lane channelization would provide acceptable levels of operation.

Table 2. Peak Queuing Conditions at Site Access Driveway – 2024 With Project and Proposed Lane Configuration[a]

Storage Lane	Average Queue	95th Percentile Queue
LOW-GROWTH SCENARIO (1.5% background growth per year)		
Northbound Left-Turn [b]	140 feet	225 feet
Southbound Right-Turn [b]	107 feet	222 feet
Eastbound Right-Turn [c]	164 feet	260 feet
Eastbound Left-Turn [c]	82 feet	216 feet
HIGH-GROWTH SCENARIO (4.0% background growth per year)		
Northbound Left-Turn [b]	140 feet	238 feet
Southbound Right-Turn [b]	103 feet	227 feet
Eastbound Right-Turn [c]	166 feet	264 feet
Eastbound Left-Turn [c]	99 feet	272 feet

Source: Heffron Transportation, Inc., May 2021. Queues determined using average of six 60-minute SimTraffic simulation runs. Results reflect the longest queues for the three time periods evaluated.

a. Proposed configuration assumes two through lanes in each direction on 228th Avenue SE, a dual left-turn lane in the northbound direction (to enter the site from the south), an auxiliary southbound right turn lane (to enter the site from the north), and three lanes exiting the proposed site access driveway

*b. Based on peak queuing condition, which occurs during the **morning peak hour**. The queue in the northbound left turn lane reflects the queue in the outside lane.*

*c. Based on peak queuing condition, which occurs during the **afternoon peak hour**.*

2.2. SE 40th Street / 228th Avenue SE Intersection

Three alternatives were evaluated for the intersection at SE 40th Street as described above. The signalized option accounts for cut-through traffic using SE 40th Street as estimated by the City's consultant. The analysis results are summarized in Table 3.. With the City-requested change in the saturation flow rates (a measure of lane capacity), the Flying T configuration has degraded levels of service compared to the prior TTR results. For the Low-Growth scenario, the intersection would operate at LOS A overall during all time periods. However, some individual movements would operate poorly. Westbound left-turns from SE 40th Street are forecast to operate at LOS F during afternoon and PM peak hours with Option A and LOS E with Option B if a second northbound through lane is provided. Under the High-Growth Scenario, that movement is forecast to operate at LOS F for both design options during the afternoon and PM peak hours (LOS C in the morning peak hour).

If a traffic signal is installed, the overall intersection operations would degrade to LOS B or C, due to added signal delay for through traffic on 228th Avenue SE. Operations for side-street movements from SE 40th Street are forecast to operate at LOS D or better with a signal under either growth scenario.

Table 3. Level of Service at 228th Avenue SE / SE 40th Street Intersection – 2024 With Project

	Morning Peak Hour (7:15 – 8:15 A.M.)		Afternoon Peak Hour (3:00 – 4:00 P.M.)		Commuter PM Peak Hour (4:45 – 5:45 P.M.)	
	LOS [a]	Delay [b]	LOS	Delay	LOS	Delay
LOW-GROWTH SCENARIO (1.5% background growth per year)						
Option A – Flying T with Northbound Right-Turn Only Lane						
Overall Intersection	A	2.9	A	5.3	A	7.2
Westbound Left-Turn	C	15.6	**F**	**58.6**	**F**	**66.7**
Westbound Right-Turn	A	6.8	C	20.2	**E**	**40.6**
Southbound Left-Turn	A	4.9	C	24.5	**E**	**41.4**
Option B – Flying T with Northbound Through-Right Lane and Merge on North Side						
Overall Intersection	A	3.1	A	4.3	A	5.0
Westbound Left-Turn	B	13.9	**E**	**40.3**	**E**	**45.9**
Westbound Right-Turn	A	4.2	A	4.8	A	5.1
Southbound Left-Turn	A	5.4	C	17.4	D	27.4
Option C – Signalized Intersection						
Overall Intersection	B	17.3	A	8.5	B	11.0
Westbound Left-Turn	D	40.1	D	37.0	C	33.2
Westbound Right-Turn	B	11.1	B	17.5	C	25.2
Southbound Left-Turn	C	25.5	C	28.0	D	41.2
HIGH-GROWTH SCENARIO (4% background growth per year)						
Option A – Flying T with Northbound Right-Turn Only Lane						
Overall Intersection	A	3.6	A	8.2	B	12.3
Westbound Left-Turn	C	19.1	**F**	**130.2**	**F**	**213.1**
Westbound Right-Turn	A	9.3	**F**	**85.2**	**F**	**80.8**
Southbound Left-Turn	A	7.4	D	30.8	**F**	**74.9**
Option B – Flying T with Northbound Through-Right Lane and Merge on North Side						
Overall Intersection	A	4.2	A	5.0	A	7.5
Westbound Left-Turn	C	18.6	**F**	**55.6**	**F**	**114.7**
Westbound Right-Turn	A	4.5	A	5.0	A	5.8
Southbound Left-Turn	A	8.7	C	21.2	**E**	**48.2**
Option C – Signalized Intersection						
Overall Intersection	C	23.9	B	10.4	B	16.2
Westbound Left-Turn	**E**	**58.3**	C	34.6	D	41.4
Westbound Right-Turn	C	23.1	C	24.1	C	31.2
Southbound Left-Turn	C	30.8	D	44.8	**E**	**69.2**

Source: Heffron Transportation, Inc., May 2021. All analyses assumed a saturation flow rate of 1,750 vph per lane. Delays determined using average of six 60-minute SimTraffic simulation runs.

a. LOS = Level of service.

b. Delay = Average seconds of delay per vehicle.

Additional analysis was performed to assess the effect of merging before (south of) or after (north of) the SE 40th Street intersection, which are reflected in the Flying T Options A and B, respectively. This analysis, also performed using the *SimTraffic* microsimulation model, is based on the arterial level of service criteria in Chapter 16 of the *Highway Capacity Manual*,[3] which defines level of service based on the expected travel speed as a percentage of the free-flow speed. The northbound traffic volume on 228th Avenue SE would be highest and the level of service for the SE 40th Street intersection would be the worst during the commuter PM peak hour, so it is reasonable to evaluate the merge during just this condition. During this time period, the free-flow speed on SE 228th Avenue is 40 miles per hour (mph) The arterial level of service is based on potential reductions in the free-flow speed. The results are shown in Table 4.

The analysis shows that the location of the merge would reduce travel speeds regardless of where it is located. If located south of the intersection (with Option A), the arterial speed would decline about 4 mph in the segment between the site driveway and SE 40th Street. If the through lane is carried through the intersection (Option B), the merge on the north side of that intersection would reduce speeds by 3 to 5 mph. Under either condition, the arterial is expected to operate at an acceptable level of service. It is noted that for Option A, the merge could occur over a longer distance since motorists could extend into the length of the right turn pocket to complete their merge maneuver. For Option B, the merge area would be much shorter, and has no such buffer except the shoulder area. For Option C, the arterial speed would decline to LOS E conditions due to the signal at SE 40th Street causing additional delay to through traffic.

[3] Transportation Research Board, Version 6.0, 2016.

Table 4. 228th Avenue SE Arterial Level of Service for Merge Effects – 2024 With Project

Section of Northbound 228th Avenue SE	Commuter PM Peak Hour (4:45 – 5:45 p.m.) Speed (mph)	LOS [a]
LOW-GROWTH SCENARIO (1.5% background growth per year)		
Option A – Flying T with Northbound Right-Turn Only Lane		
Site Access Driveway to SE 40th Street	22	C
SE 40th Street to north	31	B
Option B – Flying T with Northbound Through-Right Lane and Merge on North Side		
Site Access Driveway to SE 40th Street	26	C
SE 40th Street to north	28	B
Option C – Signalized Intersection		
Site Access Driveway to SE 40th Street	17	D
SE 40th Street to north	32	B
HIGH-GROWTH SCENARIO (4% background growth per year)		
Option A – Flying T with Northbound Right-Turn Only Lane		
Site Access Driveway to SE 40th Street	19	D
SE 40th Street to north	30	B
Option B – Flying T with Northbound Through-Right Lane and Merge on North Side		
Site Access Driveway to SE 40th Street	23	C
SE 40th Street to north	25	C
Option C – Signalized Intersection		
Site Access Driveway to SE 40th Street	13	E
SE 40th Street to north	31	B

Source: Heffron Transportation, Inc., May 2021. Travel speeds determined using average of six 60-minute SimTraffic simulation runs.

a. LOS = Level of service. Based on criteria in Highway Capacity Manual (HCM), Table 16-3.

3. Summary of Findings

As previously concluded in the TTR, any of the options would improve operations at the SE 40th Street / 228th Avenue SE intersection compared to conditions without the proposed project. Even though the side-street movements would operate below LOS D standards, Option A would mitigate the impact associated with the proposed schools. There is no justification to require Issaquah Schools to extend the northbound right turn lane through the intersection since the arterial segment between the proposed site driveway and SE 40th Street would operate at or better than City standards without that extension.

Option C (signalization at SE 40th Street) would also mitigate the ISD project impacts, but could attract additional cut-through traffic to the Sammamish Highlands neighborhood. A separate memorandum describes potential neighborhood traffic calming measures that could be considered to reduce the effects of cut-through traffic. That analysis determined that speed humps would be the optimal calming device for the narrow, curb-less residential streets.

It is recommended that one of the recommendations in the TTR (recommendation E) be modified to provide the City of Sammamish with flexibility to determine the desired configuration of the SE 40th Street / 228th Avenue intersection. The changes are noted with revision marks below.

E. Capacity Improvement at SE 40th Street / 228th Avenue SE – ISD would work with the City of Sammamish to identify and implement capacity improvement at this intersection. Analysis found that a Flying T configuration, which would utilize a raised center median and striping to physically separate the southbound through traffic from the other movements at the intersection, would improve operations to better than without-project conditions during all peak periods. The stop sign would remain to control westbound turns from SE 40th Street.

If this option is pursued, ISD would also construct a pedestrian sidewalk on the east side of 228th Avenue SE from SE 40th Street to the Site Driveway.

Alternatively, ISD would install a traffic signal at the SE 40th Street / 228th Avenue SE intersection with signalized pedestrian crossings on the north and east legs of the intersection. The lane configuration would be similar to the Flying J but without center median barriers on 228th Avenue SE.

If the signal option is pursued, ISD would extend the sidewalk on the west side of 228th Avenue SE to meet the crossing on the north side of the intersection (there would be no sidewalk constructed on the east side of 228th Avenue SE). In addition, ISD would construct up to four speed humps in the Sammamish Highlands neighborhood.

No other changes to the set of mitigation measures are needed.

MCH/tsm/zdg

ISD HS4-ES17_Updated Traffic Analysis for 228th Ave SE near site - DRAFT.docx